

# MONITORING SMOLT MIGRATION OF WILD SNAKE RIVER SP/SUM CHINOOK

9102800

## SHORT DESCRIPTION:

Collect time series information to examine migrational characteristics of wild ESA-listed Snake River chinook salmon stocks. Mark wild spring/summer chinook salmon parr with PIT tags; intercept and decode tagged smolts as they pass Snake and Columbia River dams.

## SPONSOR/CONTRACTOR: NMFS

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## SUB-CONTRACTORS:

N/A--No other agencies or entities will receive funding under this project.

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## GOALS

### GENERAL:

Adaptive management (research or M&E)

### ANADROMOUS FISH:

Research, M&E

### NPPC PROGRAM MEASURE:

5.9A.1

### RELATION TO MEASURE:

This project provides information on the migrational characteristics of wild stocks as called for in the annual smolt monitoring program.

### BIOLOGICAL OPINION ID:

NMFS BO RPA 13a and 13f

### TARGET STOCK

### LIFE STAGE

### MGMT CODE (see below)

Secesh R./spr/sum chinook salmon	Parr	W(L)
Elk Ck./spr/sum chinook salmon	Parr	W(L)
Cape Horn Ck./spr/sum chinook salmon	Parr	W(L)
Marsh Ck./spr/sum chinook salmon	Parr	W(L)
Sulphur Ck./spr/sum chinook salmon	Parr	W(L)
Big Ck. /spr/sum chinook salmon	Parr	W(L)
Bear Valley Ck./spr/sum chinook salmon	Parr	W(L)
W. Fork Chamberlain Ck./spr/sum chinook salmon	Parr	W(L)
Chamberlain Ck./spr/sum chinook salmon	Parr	W(L)
Valley Ck. /spr/sum chinook salmon	Parr	W(L)
E. Fork Salmon R./spr/sum chinook salmon	Parr	W(L)
Herd Ck./spr/sum chinook salmon	Parr	W(L)
S. Fork Salmon R./spr/sum chinook salmon	Parr	W(L)
Rush Ck. /spr/sum chinook salmon	Parr	W(L)
Camas Ck./spr/sum chinook salmon	Parr	W(L)
Loon Ck./spr/sum chinook salmon	Parr	W(L)

Lake Ck./spr/sum chinook salmon

Parr

W(L)

#### **AFFECTED STOCK**

Sculpin

Wild summer steelhead in Salmon R.

#### **BENEFIT OR DETRIMENT**

Unknown

Beneficial--PIT tagged for IDFG

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## **BACKGROUND**

### **STREAM AREA AFFECTED**

#### **Stream name:**

17 streams of the Salmon River

#### **Stream miles affected:**

46

#### **Hydro project mitigated:**

N/A Unknown, probably all FCRPS hydroelectric projects to some extent.

#### **Subbasin:**

Salmon River Drainage of Idaho

#### **Land ownership:**

public

#### **Habitat types:**

N/A Anadromous wild fish populations.

### **HISTORY:**

The National Marine Fisheries Service (NMFS) initiated a cooperative study with the U.S. Army Corps of Engineers (COE) in 1988 to PIT tag wild Snake River spring/summer chinook salmon parr as part of the COE transportation research program. This project continued through mid-1991, with outmigrating smolts monitored during spring and summer 1989-1991 as they passed Lower Granite, Little Goose, and McNary Dams. Beginning in 1992, this work became part of the BPA-funded Fish and Wildlife Program, and a 6-year study to examine the migrational characteristics of wild, ESA-listed Snake River spring/summer chinook salmon over a series of years spanning different environmental conditions was initiated. The study involves collecting and PIT tagging wild parr in their natal streams during summer and monitoring them as they pass downstream through the hydropower complex the following spring. The study also provides data for real-time management decisions in relation to flow augmentation, spill, and transportation efforts.

### **BIOLOGICAL RESULTS ACHIEVED:**

Results have demonstrated that migration timings of wild smolts differ markedly from those of hatchery smolts. Wild migrations tend to vary considerably between years and streams and are protracted, whereas those of hatchery fish are consistent within groups and between years and tend to be constricted. The overall timings of wild fish migrations also appear to be heavily influenced by seasonal climatic conditions and water temperatures, particularly during the early portions of the outmigrations, whereas those of hatchery fish are not. In addition, the data has been invaluable to NMFS and the Fish Passage Center for managing these ESA-listed stocks, particularly during periods of unfavorable flow conditions when the ability to mark migrating fish at river traps is decreased.

### **PROJECT REPORTS AND PAPERS:**

A series of quarterly and annual reports under the title "Monitoring the Migrations of Wild Snake River Spring/Summer Chinook Salmon Smolts" have been produced by this project. The BPA publication numbers for the Annual Report series follow:

Annual Report 1992 DOE/BP-18800-1 September 1994

Annual Report 1993 DOE/BP-18800-2 January 1995

Annual Report 1994 DOE/BP-18800-3 September 1995

Annual Report 1995 DOE/BP-18800-4 September, 1996

Annual Report 1996 DOE/BP-18800-5 (draft)

A paper detailing results of similar studies conducted from 1989 through 1991 under COE funding has been published by the North American Journal of Fisheries Management (May 1996).

### **ADAPTIVE MANAGEMENT IMPLICATIONS:**

Information gained from this project has proved invaluable to NMFS and the Fish Passage Center for managing these ESA-listed stocks, particularly during periods of low flow conditions. For example, data from wild fish migrations indicate water reserved for fish migrations may benefit wild fish in most years if it is released after about mid-May, particularly in low flow years.

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## PURPOSE AND METHODS

### SPECIFIC MEASUREABLE OBJECTIVES:

Gather data related to smolt migrational timings of individual and combined populations of wild fish and environmental conditions within the streams. Provide information on a yearly basis and determine differences between years related to seasonal climatic conditions and environmental conditions within the streams. This information is necessary for NMFS and the Fish Passage Center for managing these ESA-listed and other stocks, particularly during drought conditions.

### CRITICAL UNCERTAINTIES:

As long as adequate numbers of wild chinook parr can be PIT tagged and PIT-tag monitoring systems operate at the dams during spring and summer each year, the probability of accomplishing the stated major objectives is very high. Adequate numbers of wild chinook salmon parr for tagging is critical. There are always risks when collecting and tagging fish; however, overall mortality from collecting and tagging is expected to be less than 2% (based on previous data). Mortality for other species inadvertently collected also is expected to be less than 2%.

### BIOLOGICAL NEED:

Information on wild Snake River spring/summer chinook salmon migratory behavior during the smolt migrations are of paramount importance for protection of these fish through inseason management decisions related to flow augmentations, dam operations including spill, and transportation.

### HYPOTHESIS TO BE TESTED:

Null Hypothesis (Ho): Run-time distributions at Lower Granite Dam are not significantly different within years among wild spring/summer chinook salmon smolt populations in the Snake River drainage.

Corollary: If the null hypothesis is rejected, it is highly likely that run-timing to Lower Granite Dam is different among wild populations within years in the Snake River and that these differences may be influenced by factors such as temperature, flow, or genetics.

Criteria for rejecting Ho: The null hypothesis will be rejected if run-timing is significantly different among populations by re-sampling methods. Significance will be set at  $P < 0.05$ .

Null Hypothesis (Ho): Run-time distributions for fish from individual or combined streams or tributaries at Lower Granite Dam are not significantly different among years. Significance will be set at  $P < 0.05$ .

Corollary: If the null hypothesis is rejected, it is highly likely that run-timing of individual streams or tributaries is different among years and that these differences may be influenced by other factors such as temperature or flow.

Criteria for rejecting Ho: The null hypothesis will be rejected if run-timing of individual streams or tributaries is different among years by re-sampling methods. Significance will be set at  $P < 0.05$ .

### ALTERNATIVE APPROACHES:

N/A. No alternative approaches necessary.

### JUSTIFICATION FOR PLANNING:

N/A. This is an on-the-ground effort to benefit fish. Only NMFS, 2 coordinators.

### METHODS:

1) Chinook salmon parr are collected in 17 streams of the Salmon River drainage in July and August of each year using backpack electrofishers and seines. Portable PIT-tagging stations are used for tagging fish and are designed specifically for use beside streams in the field. Station components, setup, and PIT-tagging techniques have been described by Prentice et al. in Fish-Marking Techniques, American Fisheries Society Symposium 7 Manual. Fish are dipped from live cages with sanctuary dip nets and poured into plastic pans containing anesthetic; after anesthetization, chinook salmon parr greater than 54 mm in fork length are PIT tagged. Fish are allowed to recover after tagging for a minimum of 0.5 h before release into the stream at the same location where they were collected. About 10% are held in live cages for 24-h for delayed mortality and tag loss information.

2) Surviving PIT-tagged wild chinook salmon smolts are subsequently detected at downstream dams the following spring and summer. The following statistical analyses have been used in Annual Reports.

a. Length distributions (at tagging) vs. length distributions for detected fish (at tagging)---Chi-square

- b. Mean length at tagging vs. length of detected fish (at tagging), overall and during segments of the outmigration---one and two-sample Z-tests.
  - c. Diel timing at dam fish facilities---Chi-square.
  - d. Comparison of detection rates at dams for fish PIT tagged and released under different water temperature scenarios---two-sample Z-tests.
  - e. Comparison of arrival timing distributions for fish from individual streams at Lower Granite Dam---Student-Newmann-Keuls multiple comparison method.
- 3) Wild Snake River spring/summer chinook salmon are used in this study. The minimum number of wild fish PIT tagged per stream is about 1,000; the maximum about 3,000. This produces about 30-300 smolts detected at Lower Granite Dam for timing purposes.

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## PLANNED ACTIVITIES

### SCHEDULE:

<b><u>Planning Phase</u></b>	<b><u>Start</u></b> 6/1991	<b><u>End</u></b> ongoing	<b><u>Subcontractor</u></b>
<b><u>Task</u></b> Continue to assess the migrational characteristics of wild Snake River spring/summer chinook salmon smolts from selected streams.			
<b><u>Implementation Phase</u></b>	<b><u>Start</u></b> 12/1993	<b><u>End</u></b> 2005	<b><u>Subcontractor</u></b>
<b><u>Task</u></b> Continue to document and assess what environmental factors control migrational timings of wild spring/summer chinook salmon.			
<b><u>O&amp;M Phase</u></b>	<b><u>Start</u></b> 4/1992	<b><u>End</u></b> ongoing	<b><u>Subcontractor</u></b>
<b><u>Task</u></b> Continue to provide data for inseason management decisions related to flow augmentation, spill, and transportation.			

### PROJECT COMPLETION DATE:

2005

### CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:

Factors that may cause schedule or budget changes are: continued issuance (or not) of an Idaho state collectors permit, the number of wild chinook salmon parr available to tag each year, and change in the status of existing PIT-tag monitoring systems at the dams.

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## OUTCOMES, MONITORING AND EVALUATION

### SUMMARY OF EXPECTED OUTCOMES

#### Expected performance of target population or quality change in land area affected:

The study will provide basic information for management of hydrosystem operations to improve the survival of ESA-listed Snake River wild spring/summer chinook salmon as they pass through the FCRPS. These efforts started in 1992 and are continuing.

#### Present utilization and conservation potential of target population or area:

The ultimate conservation potential would be to restore listed Snake River wild spring/summer chinook salmon to allow a sustainable harvest in the fisheries in conjunction with healthy sustainable reproductive populations. Time frame 10-30 years from now.

#### Assumed historic status of utilization and conservation potential:

The assumed conservation potential for the return of adult wild spring/summer chinook salmon to the Snake River based on historic information prior to 1970, would be 50,000 to 79,000 fish with an average return rate of 4.4%. Historic utilization perhaps was 50%. Time frame for accomplishment 10-30 years.

#### Long term expected utilization and conservation potential for target population or habitat:

Same answer as given in B. Time frame 10-30 years.

**Contribution toward long-term goal:**

Improved information for management of hydrosystem operations to improve the protection and passage survival of ESA-listed Snake River wild spring/summer chinook salmon as they pass through the FCRPS. This has occurred since 1992 and continues to improve as yearly data becomes available.

**Indirect biological or environmental changes:**

Man-made environmental changes to the river that could be made from information provided by this project, indirectly, may be such things as alterations or removal of some dams, and habitat improvement projects. Time frame 5-50 years.

**Physical products:**

Numbers of wild chinook salmon parr to be PIT tagged per year would be 10,000 to 30,000.

**Environmental attributes affected by the project:**

Information from this project already is used to request increases in flow for the water budget for wild fish during the out-migration. Environmental monitors in streams could indicate water pollution, etc. which may directly or indirectly affect human use of the land adjacent or upstream.

**Changes assumed or expected for affected environmental attributes:**

Changes for affected environmental attributes would only occur if a problem was detected by our environmental monitors.

**Measure of attribute changes:**

N/A-- Turbidity will be measured in selected streams over time, 1996-?

**Assessment of effects on project outcomes of critical uncertainty:**

Unquantifiable.

**Information products:**

Information on wild Snake River chinook salmon migratory behavior during smolt migrations are of paramount importance for protection of these fish through inseason management decisions related to flow augmentations, dam operations including spill, and transportation.

During the first 4 years, we have gathered valuable and unique data related to the smolt migrational timings of individual and combined populations of wild fish. We have determined that timings of wild fish differ markedly from those of hatchery fish. Wild migrations tend to vary considerably between years and streams and are protracted, whereas those of hatchery fish are consistent within groups and between years and tend to be constricted. The overall timings of wild fish migrations also appear to be heavily influenced by seasonal water temperatures, particularly during the early portions of the outmigrations, whereas those of hatchery fish are not. In addition, the data proved invaluable to NMFS and the Fish Passage Center from 1992-1994 for managing these ESA-listed stocks, particularly during drought conditions. This need will continue into the foreseeable future. In 1994, environmental monitoring systems were installed in several selected streams to provide data which will be used to determine what environmental factors influence the migrational timings of wild chinook smolts.

**Coordination outcomes:**

Extensive coordination between IDFG, ODFW, Nez Perce Tribe, UofI, and Sho-Ban Tribe has occurred over the course of this study, before, during, and after field work. Overall, coordination outcomes were successful and positive.

**MONITORING APPROACH**

The region should measure the project's biological or environmental outcomes by: 1) accessing DART on the Internet for real-time information on wild fish migrations during the out-migration, 2) directly downloading PIT-tag detection information for wild fish from the PTAGIS database at the Pacific States Marine Fisheries Commission (PSMFC), and 3) Fish Passage Center (FPC) weekly reports, progress, and annual reports from this project.

**Provisions to monitor population status or habitat quality:**

This project is designed to monitor timing of wild Snake River spring/summer chinook salmon smolts at dams and to determine what factors may affect timing; other BPA projects, States, and Federal Agencies closely monitor actual stock populations over time.

**Data analysis and evaluation:**

Same as answers 2a through 2e, under METHODS; also in addition, we will analyze arrival timing distributions at Lower Granite Dam for fish from individual and combined streams between years, probably after at least 5 years of data. We will probably use the Student-Newmann-Keuls multiple comparison method.

**Information feed back to management decisions:**

Same as the first answer under Monitoring Approach

**Critical uncertainties affecting project's outcomes:**

Physical numbers of chinook salmon parr available for PIT tagging from year to year will continue to be a critical uncertainty that little can be done about in the short term. However acquisition of State of Idaho collectors permits and continued operation of the PIT-tag monitoring systems at the dams can be assured through regional consensus and appropriate funding.

**EVALUATION**

The adaptive management approach that uses wild fish timing information at the dams, both real-time and retrospective, to dictate when to use water set aside for fish during the out-migration, how to operate dams with respect to spill, transportation, bypass, etc. to benefit wild fish from year-to-year. The ultimate success of such management measures could eventually be evaluated (in part) by adult returns.

**Incorporating new information regarding uncertainties:**

Unknown.

**Increasing public awareness of F&W activities:**

The public will only become aware of important results from this study on wild fish migrations and its implications, by public meetings, newspapers and other media, and reports. Only in this way will the public realize what is being done in the region to enhance fish.

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**RELATIONSHIPS**
**RELATED BPA PROJECT**

9102800 Monitoring Smolt Migration of Wild Snake River Sp/Sum Chinook

9202604 Spring Chinook Salmon Early Life History

9102800 Monitoring Smolt Migration of Wild Snake River Sp/Sum Chinook

8909800 Idaho Supplementation Studies (iss)

9107300 Idaho Natural Production Monitoring and Evaluation 83-7(esa)

9102800 Monitoring Smolt Migration of Wild Snake River Sp/Sum Chinook

9302900 Survival Estimation for Dam/Reservoir Passage

**RELATED NON-BPA PROJECT****RELATIONSHIP**

information includes some Oregon streams.

information includes some Oregon streams.

information used by this study in certain streams for background info. for supplementation.

information used by this study in certain streams for background info. for supplementation.

Intensive eval. and monitoring of fish in adjacent streams to those covered by 9102800.

fish used in survival estimates at downstream dams.

fish used in survival estimates at downstream dams.

**RELATIONSHIP**

Spring Chinook Salmon Early Life History/ODFW  
Steelhead Supplementation Studies in Idaho Rivers/IDFG

Monitoring wild PIT-tagged spr/sum chinook salmon from  
northeast Oregon  
Monitoring wild PIT-tagged steelhead at downstream dams.

#### OPPORTUNITIES FOR COOPERATION:

Continued close coordination with and cooperation by the Idaho Department of Fish & Game (IDFG) is important, including the continued issuance of state collector permits. Also, when requested by IDFG, this project PIT tags wild steelhead for continuing BPA projects such as 9005500 or 9107300. In addition, collecting gear and PIT tag equipment have been reciprocally shared with project 9107300 and 8909803.

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#### COSTS AND FTE

**1997 Planned:** \$303,800

#### FUTURE FUNDING NEEDS:

<u>FY</u>	<u>\$ NEED</u>	<u>% PLAN</u>	<u>% IMPLEMENT</u>	<u>% O AND M</u>
1998	\$227,500	10%	90%	0%
1999	\$408,800	10%	90%	0%
2000	\$244,800	10%	90%	0%
2001	\$256,000	10%	90%	0%
2002	\$300,000	10%	90%	0%

#### PAST OBLIGATIONS (incl. 1997 if done):

<u>FY</u>	<u>OBLIGATED</u>
1991	\$216,900
1992	\$311,700
1993	\$113,500
1994	\$231,400
1996	\$185,700

TOTAL: \$1,059,200

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

<u>FY</u>	<u>OTHER FUNDING SOURCE</u>
1998	NMFS
1999	NMFS
2000	NMFS
2001	NMFS
2002	NMFS

<u>AMOUNT</u>	<u>IN-KIND</u>	<u>VALUE</u>
NA	\$25,000	
NA	\$25,000	
NA	\$25,000	
NA	\$25,000	
NA	\$25,000	

#### OTHER NON-FINANCIAL SUPPORTERS:

IDFG, ODFW, USFWS, Nez Perce Tribe, Sho-Ban Tribe, UofI.

**LONGER TERM COSTS:** If continued monitoring occurs beyond 2002, annual projected costs would range from 250K

**1997 OVERHEAD PERCENT:** 15-20% depending on the percentage of total costs of any one year that cover labor.

#### HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:

That percentage is of the total costs. Overhead is applied at a rate of 45.6 % of total direct labor only.

**SUBCONTRACTOR FTE:** None